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*a Poetic Device and Technical Tool to Improve Life in Energy Positive Homes*

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# The Window - a Poetic Device and Technical Tool to Improve Life in Energy Positive Homes - a Case Study of an Active House



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## 1. Introduction

The aim of this paper is to illustrate how a holistic approach to the window as a design element can be used as a poetic device and technical tool to improve quality of life in energy positive homes.

Through a case study of the residential building Home for Life, built in accordance with the Active House vision, 'fictive user statements' from the design phase and the end users' experience of living in the house form the primary source to define and evaluate the potentials of the window. We explore the interaction between the window used to optimise indoor environment and provide the house with solar energy and the window used to create living environments that bring into play the surrounding environment.

### 1.1 Paper hypothesis

Through this paper the hypothesis the window (defined as four window design elements) as **poetic device** (expression of space and materials evoked through daylight and Indoor and outdoor relations) and **technical tool** (functional daylight conditions, fresh air and comfortable temperature and solar heat gain) is tested. The hypothesis explores the assumption that by designing to high technical standards, the aesthetic and poetic qualities of the house are also enhanced.

### 1.2 The window as design element

Throughout the design of the house window elements and daylight have had a central role. The window area is 70 m<sup>2</sup> corresponding to 40% of the floor area. The window area of the four facades is distributed as follows: 70% South, 5% north, 11.5% east and 11.5% west. During the heating season, automatic natural ventilation from the window openings is supplied by mechanical ventilation by heat recovery. The energy frame simulation program BE06 estimates that 50% of the energy needed for heating is covered through passive heating through the windows [7].

The house can be defined and analysed by the four window design elements outlined below.

## 2. Analyses

The analyses are based on the definition of four window design elements used in the house: the south facing active window façade, the east and west facing square windows, the north facing roof windows and the light cross. The window design elements are analysed and their potentials as a poetic device and a technical tool to improve life are accentuated.

To explore whether the stated hypothesis can be verified or not the case study house Home for Life is analysed. There are three main data sets used: the technical performance measures: the experiences of occupants: and the phenomena of light as captured through photography and daylight modelling. The analyses put forward here not only focus on user perspectives and experiences from living in the house but sets these within wider cultural contexts. Methods and

data are part of an ongoing research project called MIMA [8]. The analyses in this paper focus on the user perspective reflected in the quote ‘Just imagine if the quality of our buildings was measured by their ability to improve life’ [8].

*Table 1 Window design elements.*

South facing active facade	East and west facing windows	North facing roof windows	Light cross
			

*“For the purposes of this kind of research the only reliable instruments of observation are the human senses.” – Dean Hawkes [9]*

Together the quantitative and qualitative methods will attempt to measure, register and capture the poetic and technical aspects of the house [4].

### 3. Conclusion

The paper concludes that poetic potentials as well and technical potentials are enhanced by integrating windows as key design elements in energy positive buildings. The case study shows that intake of daylight from various directions supports the utilisation of technical needs such as fresh air for natural ventilation, functional daylight and passive heat gain. However, the case study also shows that poetic qualities, such as indoor-outdoor relationships and the impact of daylight on the experience of architectural space, is also enhanced.

*Table 3 Conclusions presented in table form. The table present whether the hypotheses can be verified or not.*

	South facing active façade	East and west facing windows	North facing roof windows	Light cross
<b>Poetic devices</b>	<b>Both yes and no</b> Yes: Openness underlines indoor/outdoor relation and good daylight conditions. No: The transparency displays the occupants and limits privacy.	<b>Yes</b> Yes: Variation of light intake creates possibilities in spatial experiences changing over day and year, casting light deeply into the space; the sills provide built-in furniture.	<b>Yes</b> Yes: Diffuse daylight contribute to experiential qualities of space and provide a good even daylight environment.	<b>Yes</b> Yes: Transparency creates a feeling of safety for the occupants and the doors provide direct access to the surrounding in all directions.
<b>Technical tools</b>	<b>Both yes and no</b> Yes: Passive energy from solar heat gain. No: Too much solar heat gain creates overheating, sunscreen and natural ventilation required.	<b>Both yes and no</b> Yes: Provides daylight deep into the spaces morning and evening No: The low solar inlet during spring and fall result in overheating.	<b>No</b> No: No passive energy contribution through the window but energy loss.	<b>Yes</b> Yes: Possibility of cross ventilation, intake of air for natural ventilation and letting daylight deeply into the spaces throughout the entire year.

The key finding in this paper is that an energy efficient design with focus on utilising the window as design element brings possibilities of daylight maximisation (less electricity for electrical lightning) and solar heat gain (less energy for heating). This strongly supports the ideals behind the Active House vision of creating sustainable architecture focusing on occupants’ needs and quality of life.